

# CEOS LAND PRODUCT



## SUBGROUP REPORT

**F. Baret, J. Morisette & S. Garrigues**

WGCV Plenary Chiang Mai 2006

# LPV outline



- Subgroup administrative issues
  - goals and objectives
  - Fred Baret is now chairing, Sebastien Garrigues is serving as vice-chair
- LPV accomplishments
  - Web site initiated and maintained
  - Special Issue published in July 2006
  - Three workshops: Albedo, VI time series and Global Vegetation monitoring
  - Report from GVM meeting
- Future
  - Contribution to GEO/GEOSS
  - Future meetings

# CEOS Definition



## Validation:

*the process of assessing by independent means the quality of the data products derived from the system outputs*

LPV operates under this definition, but with the understanding that validation activities should consider user accuracy needs and feedback to algorithm improvements.

# Products considered



- Land\_cover (including change detection)
- Fire (active/ scars)
- Energy (LST/ albedo/ PAR/ SWR/ LWR)
- Vegetation (LAI/ fAPAR/ fCover/ VIs/ biomass)
- Soil (moisture, soil type ...)

Higher level products not yet considered  
(Evapotranspiration, Net Primary Productivity, ...)

# Mission Statement & Goals

- to foster **quantitative validation** in a traceable way of *higher level global land products* derived from remote sensing data and relay results so they are relevant to users
- to increase the **quality and efficiency** of global satellite product validation *via* developing and promoting international standards and protocols for field sampling, scaling, error budgeting, data exchange
- to provide feed-back to international structures (GEO/GEOSS) for :
  - **requirements and achievements on product accuracy**
  - **definitions of future mission**

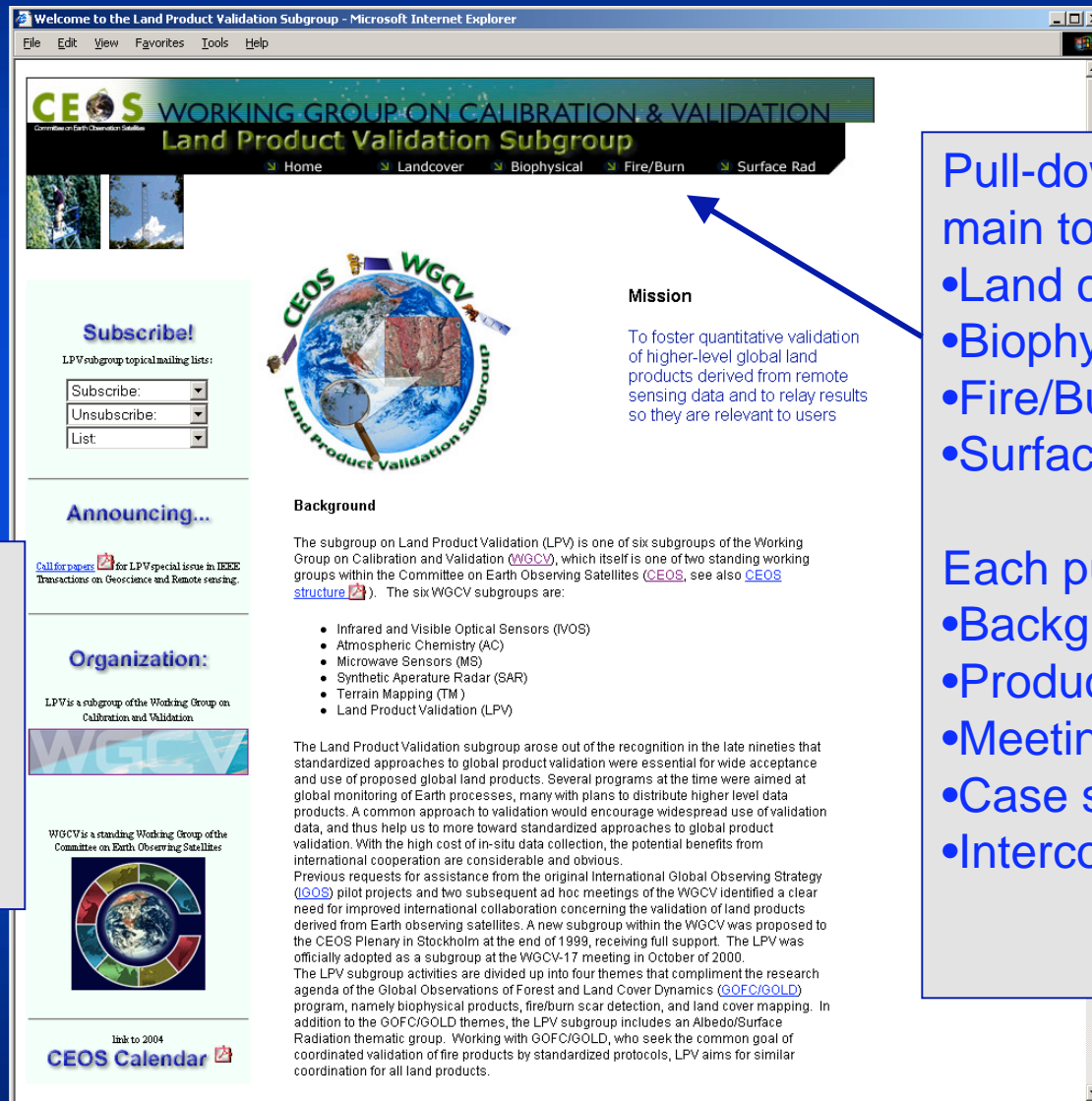


# http://lpvs.gsfc.nasa.gov

Matches WGCV  
page layout and  
graphic

Quick links to:

- Listserves
- Announcements
- WGCV
- CEOS and
- CEOS calendar



Pull-down menu for  
main topical areas:

- Land cover
- Biophysical
- Fire/Burn
- Surface Radiation

Each pull-down lists:

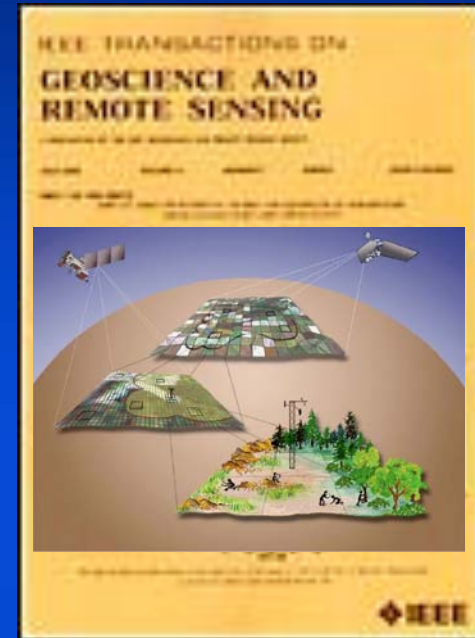
- Background
- Producers \*
- Meetings
- Case studies
- Intercomparisons

\* input needed

web curator: Jaime Nickeson, NASA GSFC

# LPV “Special Issue” of IEEE TGRS

- Special Issue: describing the state of the art research on both protocol and results for validation and accuracy assessment of global land products  
(Morisette, Baret, and Liang guest editors)
- Three “framework” papers  
19 “validation results” and  
four “user response” papers - an attempt to solicit “user feedback”.



	2004												2005												2006											
	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	N	D	J	F	M												
Announcement																																				
Validation papers				submissions					reviews					revisions		review		final/profs																		
User perspective papers							submissions							reviews		revisions		final/profs																		
Publication date																																				
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July 2006

# Previous workshops

- 1) First Workshop - LAI Intercomparison  
7-8/6/2001 ESA Frascati, Italy
- 2) CEOS/WGCV Land Product Validation Workshop on Surface Albedo  
Boston University  
Boston, MA USA  
10/23/2002 - 10/24/2002
- 3) CEOS LAI Intercomparison Activity Results  
16/8/2004 University of Montana, Missoula, MT USA
- 4) Global Vegetation Continuous Fields (VCF) Validation Workshop  
27-28/10/2005 Geographic Information Science Center of Excellence  
Brookings, SD USA
- 5) LPV workshop on albedo  
April 27-28, 2005, Vienna, EGU  
Reported in NASA EOS "Earth Observer"  
[http://eospsso.gsfc.nasa.gov/eos\\_observ/pdf/May-Jun05.pdf](http://eospsso.gsfc.nasa.gov/eos_observ/pdf/May-Jun05.pdf)
- 6) LPV workshop on long-term VI record  
Aug 7, 2006 University of Montana, Missoula Montana  
Reported in NASA EOS "Earth Observer"  
[http://eospsso.gsfc.nasa.gov/eos\\_observ/pdf/Nov-Dec06.pdf](http://eospsso.gsfc.nasa.gov/eos_observ/pdf/Nov-Dec06.pdf)
- 7) Long term global monitoring of vegetation variables using moderate resolution satellites  
Aug 8-10, 2006 University of Montana, Missoula Montana  
Accepted to AGU's EOS Transactions  
Presentations and posters from both meetings are posted on-line at  
[//www.ntsg.umt.edu/VEGMTG/](http://www.ntsg.umt.edu/VEGMTG/)

+ GOF-C-GOLD-FIRE meetings



# http://www.ntsg.umt.edu/VEGMTG/

NTSG Workshops

http://www.ntsg.umt.edu/VEGMTG/

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## Numerical Terradynamic Simulation Group

# Global Vegetation Workshop 2006

- **VI Validation (Aug 7):**
  - [Home](#)
- **Global Veg (Aug 8-10):**
  - [Home](#)
  - [Schedule](#)
- **Registration:**
  - [Online {Credit Card}](#)
  - [Mailing {PDF Form}](#)
  - [Register a Poster](#)
- **Missoula & Montana:**
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**Hosted By:**

## Long term global monitoring of vegetation variables using moderate resolution satellites:

*A combined meeting of the third biennial global vegetation workshop at the University of Montana and the Committee on Earth Observing Satellites Working Group on Calibration and Validation.*

### August 8-10, 2006

**University of Montana**  
**Missoula, Montana**

A number of international organizations are focusing on the requirements for, and the accuracy and use of, Earth observation from space to address both science and applications questions concerning our terrestrial environment. There are now multiple global vegetation products from several similar sensors - with more planned over the next several years. This situation has provided the impetus for the CEOS Working Group on Calibration and Validation (WGCV) through its Land Product Validation sub-Group (LPV) to better coordinate satellite-based global observations of vegetation parameters.

The primary objective of this workshop is to establish a framework to understand the inter-relationship between multiple, global vegetation products so to identify opportunities for:

- Increasing knowledge through combined products,
- realizing efficiency by avoiding redundancy, and
- developing near- and long-term plans to avoid gaps in our understanding of critical global vegetation information.

### August 7, 2006

VI Validation Pre-Workshop  
Validation of global vegetation indices and their time series (A CEOS Land Product Validation topical workshop)



### Call For Posters

A poster session will run throughout the entire meeting. There will be an initial poster "reception" along with registration on Monday evening, August 7th.

[Submit a Poster for the Meeting from the following specific areas:](#)

# Background on Vegetation Indices

Research is needed to build a better understanding of the determinism of **VI time series** with special attention on:

- consistency of VI time series possibly contaminated by cloud cover, sensor degradation, satellite orbital drift...
- the effect of non-photosynthetic seasonality, such as soil moisture, snow cover, etc.
- the interpretation of landscape dynamics with more than one growing season per year.

There could be better connections with, and contribute to, the weather and climate modeling communities (to investigate how climate and human activities influence land surface phenology at a range of temporal and spatial scales).

For agricultural and natural resource management applications it was felt that higher resolution in space (<250m) are needed.

NASA's VI and Phenology white papers

[http://lcluc.umd.edu/products/Land\\_ESDR/index.asp](http://lcluc.umd.edu/products/Land_ESDR/index.asp)

# Recommendation for VI validation

CEOS, through GEOSS, help maintain collaboration and coordination with in-situ data collection networks and users with the objective of demonstrating how the combined long-term time-series data can impact climate research and societal benefits.

Specific examples include:

- Phenological Networks
  - European Phenology Network is setting the standard
  - US National Phenology Network is currently being initiated
- Fluxnet
  - Existing studies have demonstrated the ability of flux tower to connect remote sensing time series with surface processes.
- Existing ground networks would be greatly enhanced if they were augmented with spatially distributed measurements of transmittance in the photosynthetically active radiation (PAR) domain and reflectance measurements of the canopy in the red and near-infrared

# Global Vegetation Monitoring: Objectives

The international workshop focused on:

- Advances in products validation
- long-term continuity of global vegetation data records
- multi-sensor approaches to vegetation monitoring
- global vegetation monitoring applications to the GEOSS “Societal Benefit Areas”
- strategic planning for future sensors



# Global Vegetation Monitoring: Objectives

## Advances in products validation

- Good progress have been achieved
- Need validation exercise as independent as possible from the producer teams
- Systematic community evaluation of available products every 2-3 years

## Intercomparison

- Global network of sites representative of the global biomes for intercomparison: BELMANIP
- Cut outs by each producers to be available to the whole community
- Data support and archiving required for this activity...
  - Using MERCURY system?
  - automatic intercomparison interface?
- Standard protocols for inter-comparison

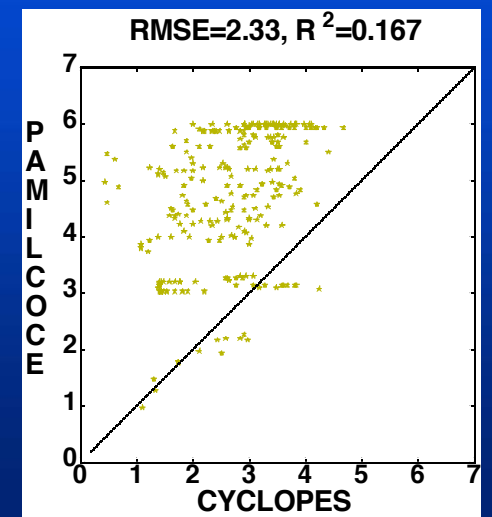
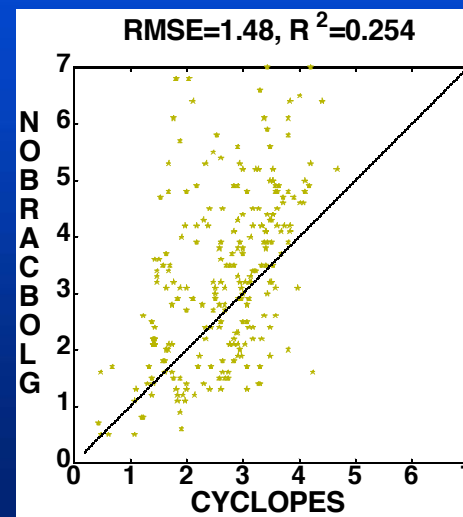
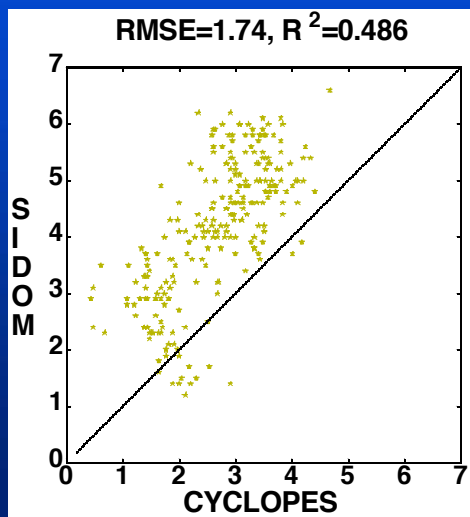
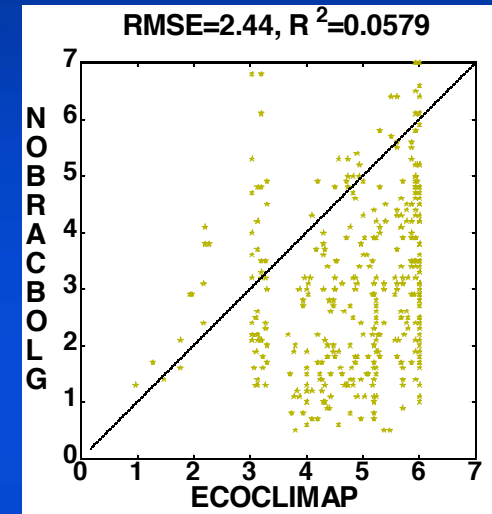
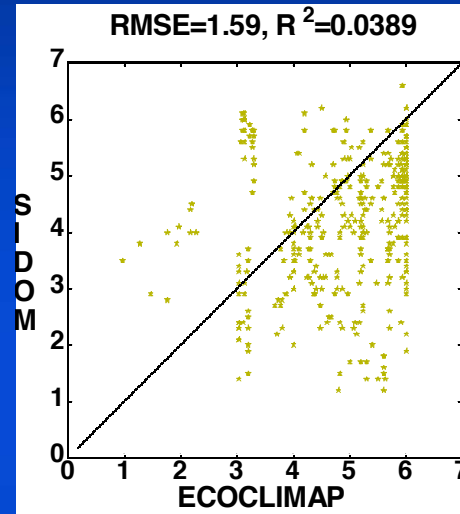
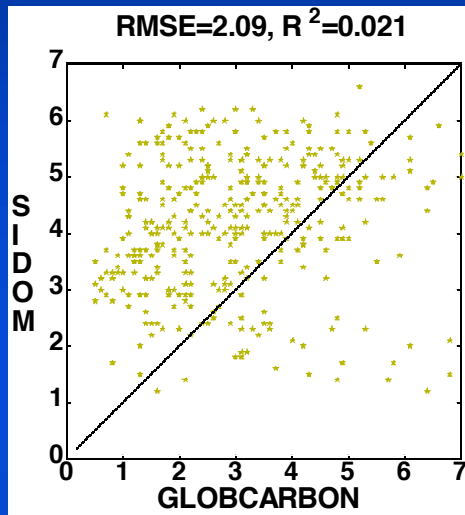
## Direct validation

- Improvements of representativeness of sites to get to stage 3 of the validation
- More sites
- Encourage synergy between ground measurements at fluxnet sites and RS validation
- **Need seasonality** description particularly for key phenological periods
- Standard protocols for measurements and data formatting and well documented
- Encourage individual groups to advertise their ground observations at the LPV web site



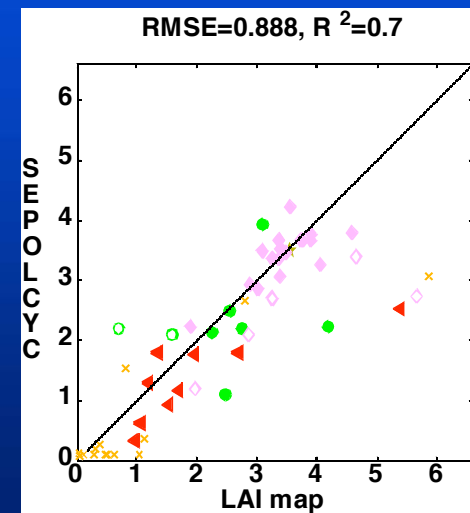
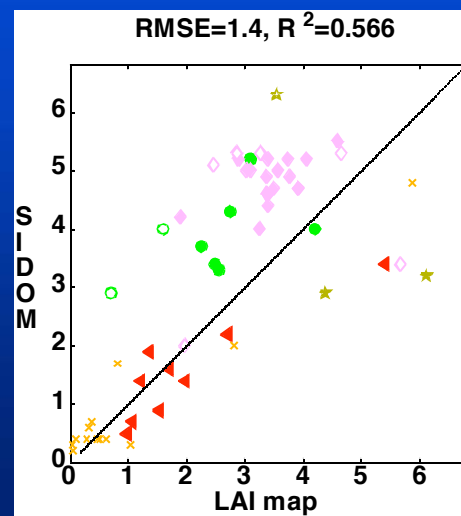
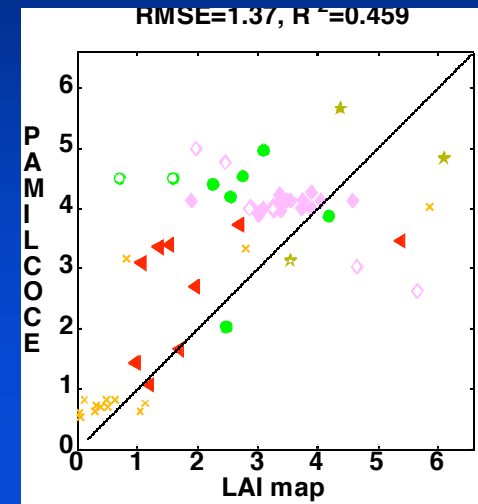
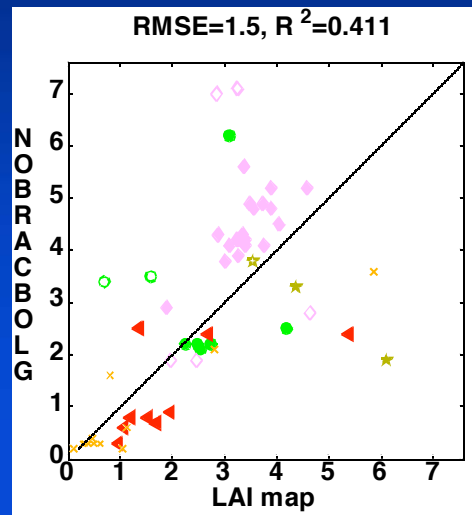
# Intercomparison

## Scatter plot over the BELMANIP sites: EBF class



# Direct validation


- Decid. Broad. For.
- Ever. Needle. Forest
- ★ Ever. Broad. Forest
- ◄ Crops
- × Grass
- ◆ Mixed Forest
- ◆ same year
- ◇ different year



# LAI validation exercise: synthesis

	ECOCLIMAP	MODIS	GLOBCARBON	CYCLOPES	CCRS
Missing data	++++	++	+++	+	+
Statistical distribution	++++	+++	+	++++	NA
Magnitude	+	++	++	++	+++
Spatial gradient	++++	+++	++	+++	NA
Seasonal trends	++++	++	++	+++	+++
In situ data	+	+++	++	++++	NA

# User requirements



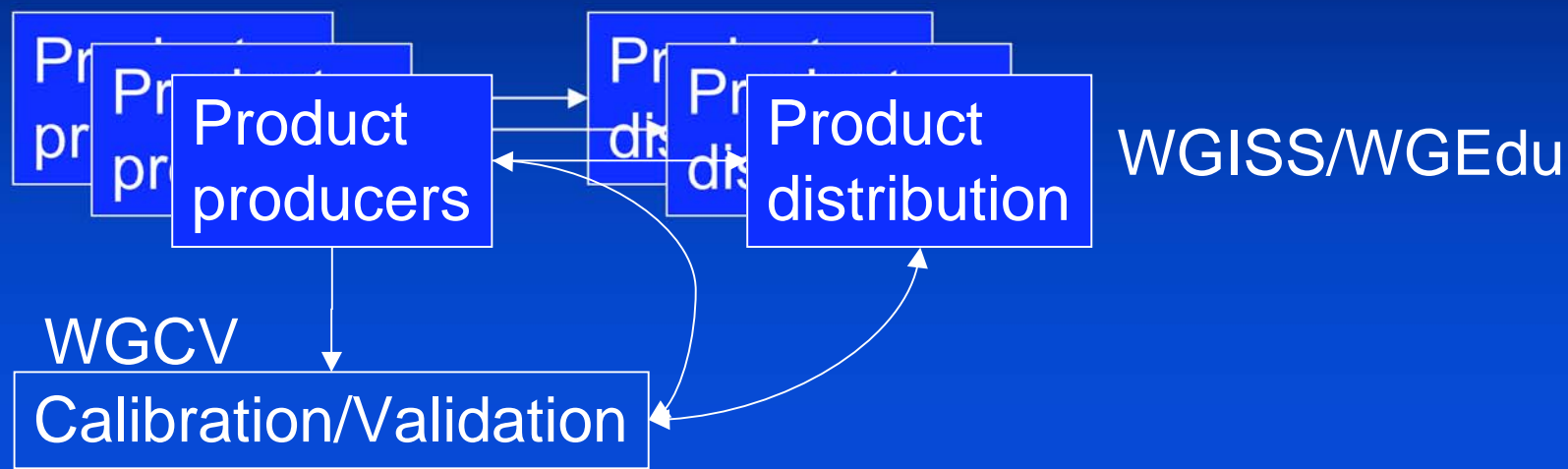
- All products should be associated to **quantitative uncertainties**, traceable to up scaled field measurements with published and reproducible protocols
- no missing data: procedures should be developed to fill the gaps
- long and consistent time series
  - Strong support of the reprocessing/benchmarking of past AVHRR data (1981...)
  - No gaps between actual series and the next ones (VIIRS, sentinel 2-3)
  - Overlap between 2 sensors necessary for the intercomparison/calibration
  - Backward compatibility
- data freely available
- spatial resolution: large improvement expected 10-50m:
  - clouds,
  - water bodies
  - heterogeneity
  - size fields
  - Use 'texture' metrics
- temporal resolution 4 to 10 days

# Global Vegetation Monitoring: Outputs

- Continuing validation/intercomparison essential: need proper support by agencies: answers the need for quantitative uncertainties
- Need for proper data fusion: should build on validation exercise
- Results from the workshop need to be brought forward and integrated in other programs and plans.
- long and consistent time series
  - Strong support of the reprocessing/benchmarking of past AVHRR data (1981...)
  - No gaps between actual series and the next ones (VIIRS, sentinel 2-3)
  - Overlap between 2 sensors necessary for the intercomparison/calibration
  - Backward compatibility
- Need large improvement in the spatial resolution for future missions: multi-agency satellite constellation and receiving/processing systems: CEOS should initiate a pilot working group on sensor constellations (for combined products and mission planning): **Virtual constellations**



# Global Vegetation Monitoring: Current situation within CEOS





# Contribution to GEO/GEOSS



- Identify opportunities for coordination and collaboration
  - Capitalize on field data networks coordinated through GEOSS
- Develop consensus “best practice” protocols for data collection and description
  - GEOSS could “approve/publish” related document
- To develop procedures in support to the validation exercise, based on data exchange and management - with a focus on land product validation core sites (done in conjunction with WGISS)
  - GEOSS could “approve” related activities
- To contribute to inter-calibration between products/sensors and accuracy assessment for data fusion (virtual constellation)

# Future meeting



- ESA cal/val portal (fall 2007)
- Soil moisture, Vegetation productivity in discussion